

FIG. 2

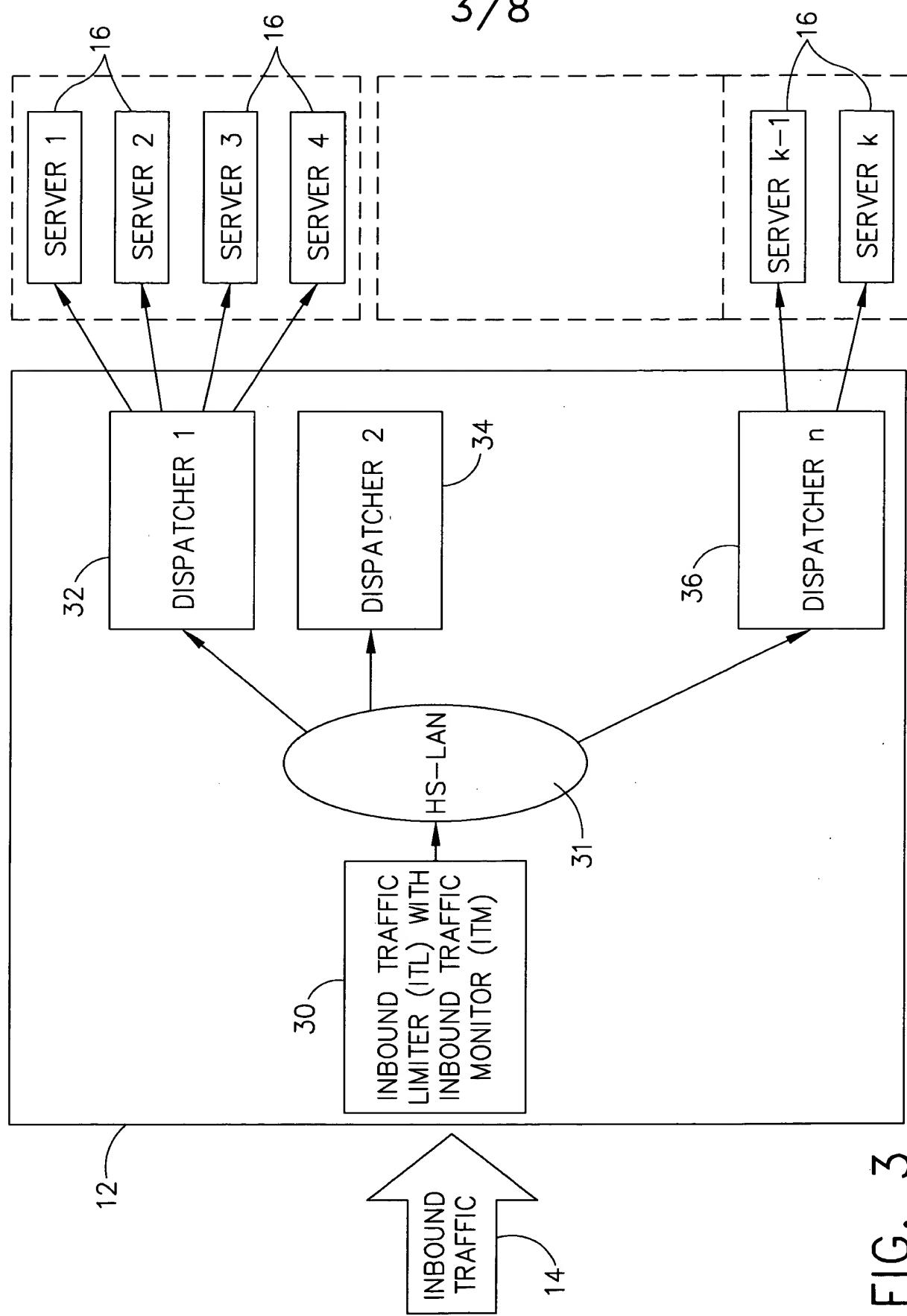


FIG. 3

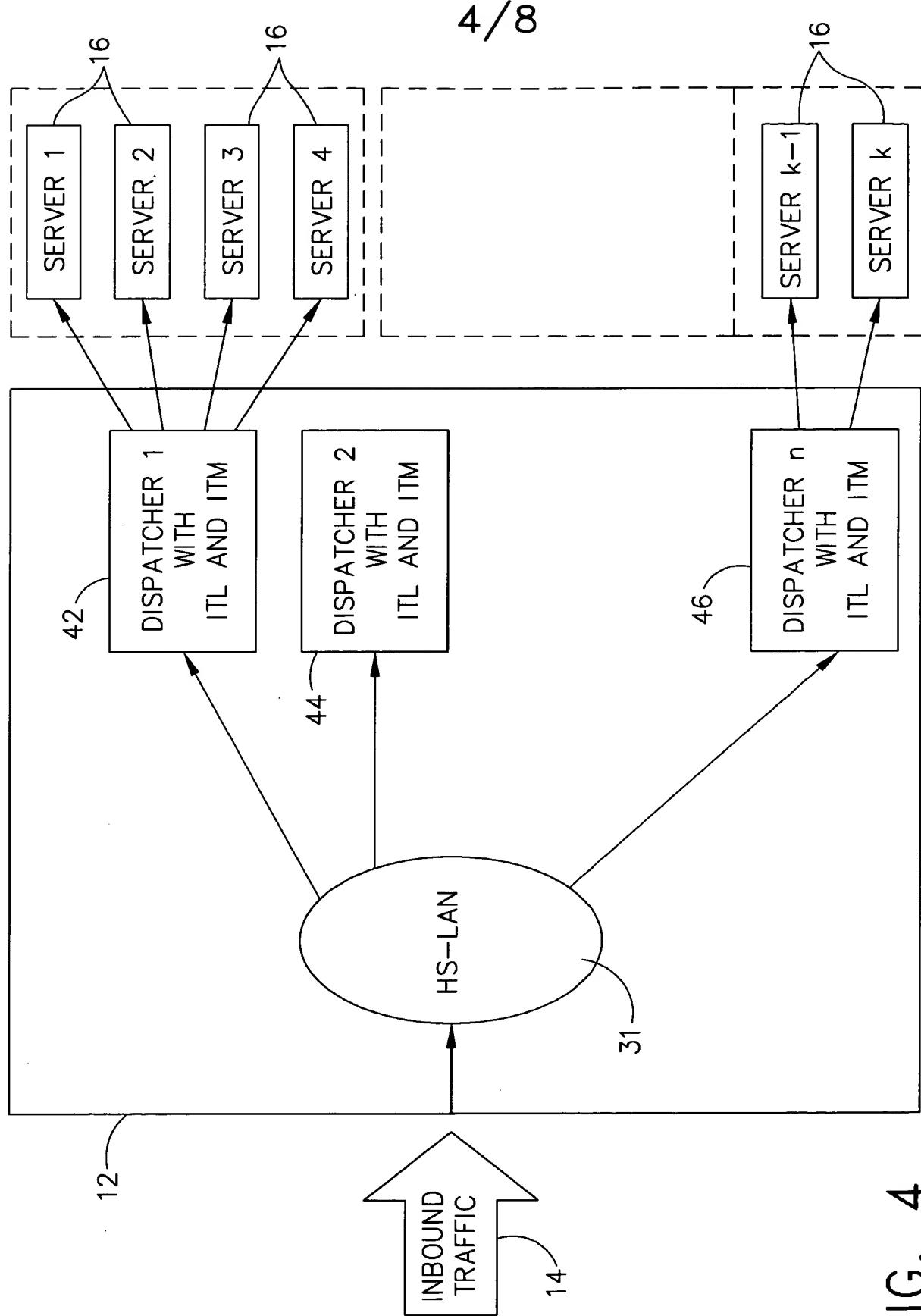


FIG. 4

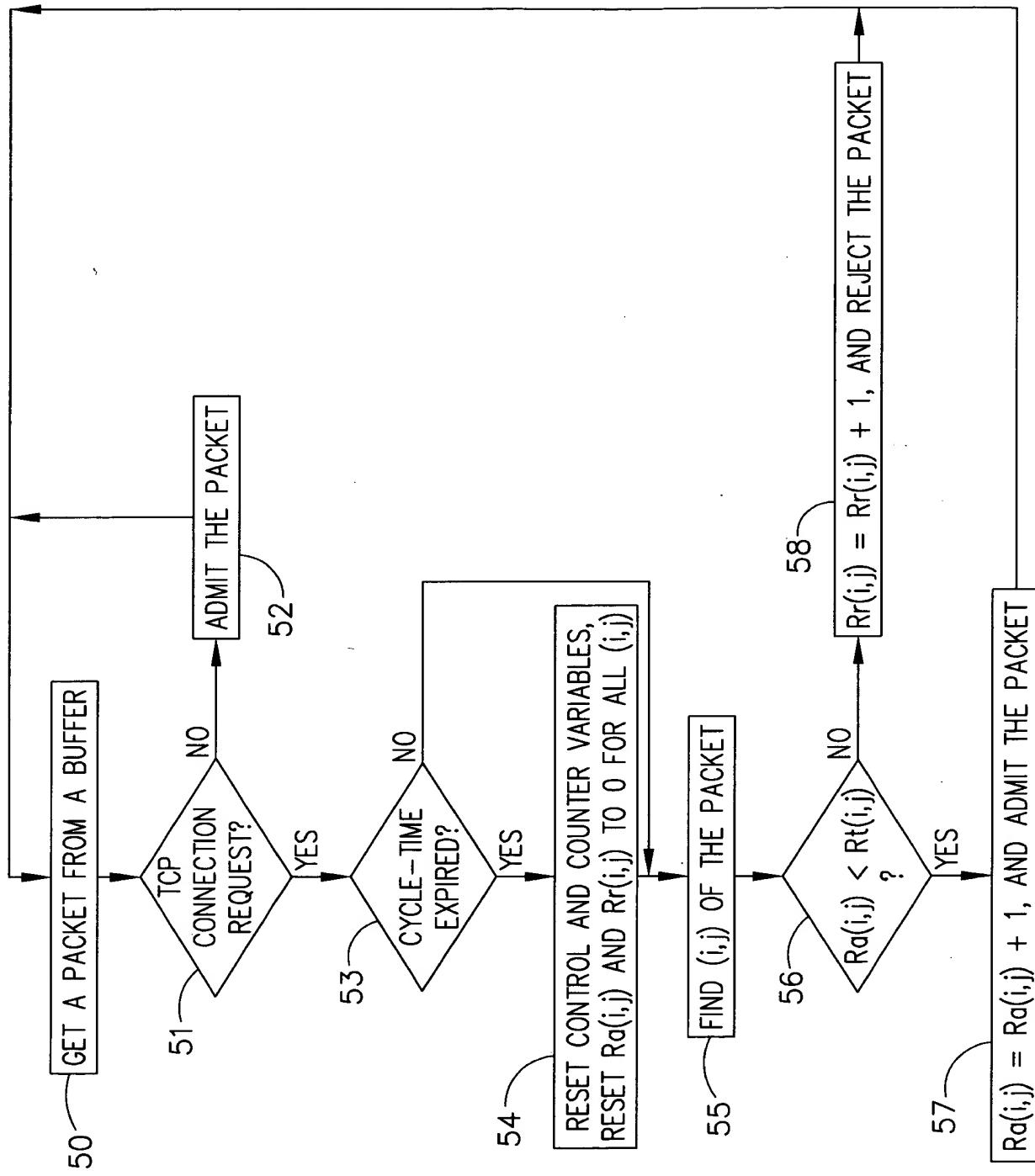


FIG. 5

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STEP 1
START:
FOR ALL (i,j), SET Bmax(i,j) = MIN (Bmax(i,j),
Rbound(i,j)*b(i,j));
/* REFLECTING "EXTERNAL CONSTRAINT" Bbound(i,j) */
/* ESTIMATING THE CURRENT OUTBOUND TRAFFIC */
/* ESTIMATING THE CURRENT TOTAL
OUTBOUND TRAFFIC */
FOR ALL (i,j), SET Bt(i,j) = b(i,j)*Ra(i,j);
LET Bt BE THE SUM OF Bt(i,j) OVER ALL (i,j);
/* LINK CONGESTION DETECTED */
/* NO REQUEST REJECTION */
/* SLA IS NOT VIOLATED. "<=" */
& Bt(i,j)<Bmax(i,j)) OVER ALL (i,j)
MEANS LESS-THAN-OR-EQUAL-TO */
IF ((Rr(i,j)=0
& Bt(i,j)<Bmax(i,j))) OVER ALL (i,j)
THEN GO TO STEP 5; ELSE GO TO STEP 2;

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STEP 2 COMPUTE_BANDWIDTH_TARGETS:
FOR ALL (i,j), SET Bt(i,j) =b(i,j)*Ra(i,j)+Rr(i,j);
/* COMPUTING NEW TARGETS FOR BANDWIDTH USAGE */
/* ESTIMATING OUTBOUND TRAFFIC WHEN ALL REQUESTS
ARE ADMITTED */
FOR EVERY (i,j) SUCH THAT Bt(i,j)>Bmax(i,j)
/* THIS STEP IS NEEDED SINCE Bt(i,j) WERE JUST
RE-COMPUTED */
FIRST SET Bt = Bt-Bt(Bt(i,j)-Bmax(i,j))
/* WANTS TO GENERATE MORE THAN THE MAXIMUM SLA */
IF Bt <= Btotal
THEN SET Bt(i,j) =Bmax(i,j);
/* ADJUST EXPECTED TOTAL OUTBOUND TRAFFIC */
THEN GO TO STEP1; ELSE GO TO STEP 3;
/* BOUNDING TRAFFIC BY MAXIMUM SLA */
/* NO LINK CONGESTION WILL BE ANTICIPATED */

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STEP 3 LET Bexcess BE THE SUM OF (Bt(i,j)-Bmin(i,j)) OVER THOSE Bt(i,j)>Bmin(i,j);
/* COMPUTING "EXCESS" BANDWIDTH */
/* PERFORM EITHER CASE 1 OR CASE 2 */
/* CASE 1: COMPUTE "SHARABLE" BANDWIDTH WHEN BANDWIDTH BORROWING IS PERMITTED */
LET Bshareable BE Btotal MINUS THE SUM OF SMALLER OF (Bt(i,j) AND Bmin(i,j)) OVER ALL (i,j);
/* CASE 2: COMPUTE "SHARABLE" BANDWIDTH WHEN BANDWIDTH BORROWING IS NOT PERMITTED */
LET Bshareable BE Btotal MINUS THE SUM OF Bmin(i,j) OVER ALL (i,j);
FOR EVERY (i,j) SUCH THAT Bt(i,j)>Bmin(i,j) /* PERFORM FAIR PRORATION */
SET Bt(i,j) = Bmin(i,j) + (Bt(i,j) - Bmin(i,j)) * (Bshareable/Bexcess);

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STEP 4 COMPUTE_NEW_RATES:
FOR EVERY (i,j) SUCH THAT Bt(i,j)<=Bmin(i,j) /* THIS IS EQUIVALENT TO "NO THROTTLING" */
SET Bt(i,j) = Bmax(i,j); /* COMPUTING TARGET RATES */
FOR EVERY (i,j) SET Rt(i,j) = Bt(i,j)/b(i,j); /* OPTIONAL COMPUTATION, RATE FOR EACH SERVER */
OPTIONALLY COMPUTE Rt(i,j,k) FROM Rt(i,j)
FOR ALL k;

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STEP 5 STOP;

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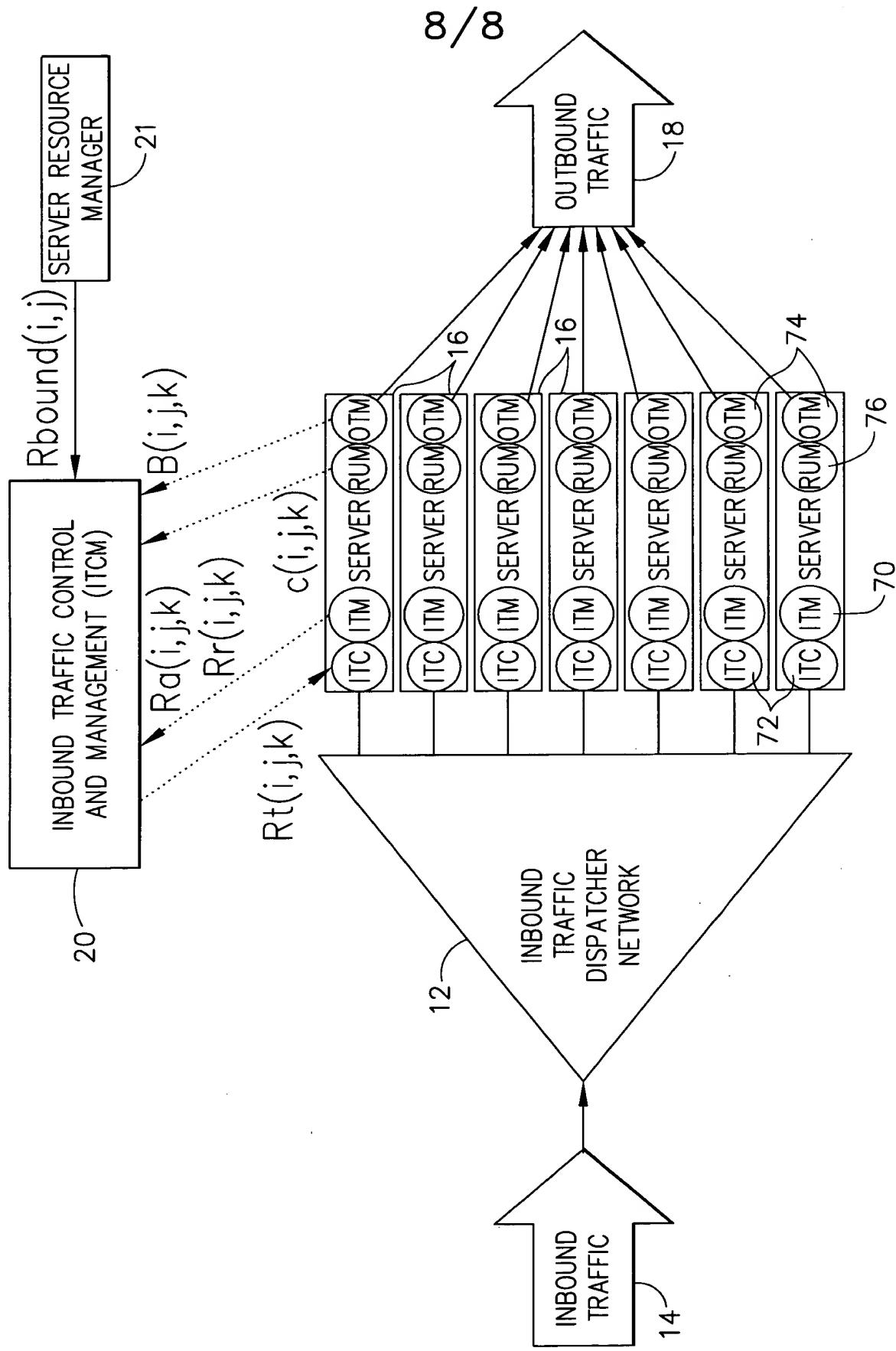


FIG. 7